Laboratory
...ity Testing
Summary

1981
Annual
Report

MANITOBA
AGRICULTURE
...Dairy Branch
...Dairy Section

F O R E W O R D

This report contains the annual summary of test results of the Dairy Laboratory of the Animal Industry Branch, Manitoba Agriculture. The Laboratory is located at the Agricultural Services Complex, University of Manitoba, Winnipeg.

Samples analysed at the laboratory continue to provide information on dairy products and milk samples for quality control, health requirements, payment to producers, and extension activities within the dairy industry. The analyses required to provide this information are many and cover a variety of test procedures. The results for 1981 are summarized in the tables given in this report.

The Milko Scan 203 was first put into use in 1979 and has been operational since that time. Results for fat, protein, and lactose are determined on all producer herd samples as well as on cow samples for the centrally tested D.H.I.A. and Owner Sampler programs.

Due to the integration of the DHIA program into Central testing and the significant growth in this program, a considerable increase in work load was experienced in the milk composition unit of the Dairy Laboratory. This integration was completed in 1980. Information on protein inversions continues to be available to extension personnel as an aid in correcting the problems of feeding and herd management.

All tests for payment purposes for the Manitoba Milk Producers' Marketing Board are done weekly by the Milko Scan 203, on fresh milk samples. These weekly test results are transmitted to the Marketing Board via computer interchange, with the butterfat results used to determine the value of milk shipments based on a butterfat differential. Protein and lactose results continue to be entered in the computer storage tape for possible future use.

In 1981 a Hewlett Packard 85 instrument controller was installed in the Dairy Laboratory. All producer test data from the Milko Scan can now be automatically recorded on tape and then transferred to the Milk Marketing Board Computer via telephone line.

LABORATORY STAFF

D. M. Macaulay, BSA., MSc	Dairy Laboratory Specialist
Mary Anne Kuebler, BSc	Supervisor, Microbiology Lab.
Lynne Macaulay	Supervisor, Milk Composition Lab.
On Chan, BSc	Technician
B. Kupskay, BSc, MSc	Technician
Glenna Wentworth, Dip. of Biological Tech..	Technician
Ed P. Taylor	Technician
Tannis Paton, BSc	Technician

DAIRY LABORATORY FUNCTIONS

The Dairy Laboratory is a central testing facility within the Dairy Section of the Animal Industry Branch, Manitoba Agriculture. The basic functions of the laboratory are:

1) Testing of raw milk to insure that it meets the quality requirements as outlined in the Dairy Act and Public Health Act.
2) Testing of pasteurized dairy products to insure that all Public Health safeguards are met and to provide information in keeping quality estimations.
3) Testing of pasteurized dairy products to insure that all composition paramenters are maintained.
4) Testing for butterfat and other components as a basis of payment to milk producers.
5) Milk Composition testing for Dairy Herd Improvement Association and Owner Sampler Milk Recording programs.
6) Assistance to field staff and industry in solving quality problems.

SAMPLING

1) The procedure in use for raw milk, involves the aseptic collection of a universal milk sample that can be used for both bacteriological and compositional analyses. Each milk shipper is supplied with sterile "whirl-pak" plastic bags, identified with his name and number. These bags are used for representative sampling by the Bulk Milk Grader at each Bulk Milk pick-up. The milk samples so collected are stored in an ice water container on the truck and then transferred to a refrigerated storage at the dairy plant prior to delivery to the laboratory. All samples are delivered to the dairy laboratory within 48 hours of pick-up and must arrive at a temperature below $5^{o}C$.
2) Sampling and testing of all pasteurized fluid products is done not less than once per week. The products include cottage cheese, sour cream, cream cheese spread, as well as fluid milk products. Butter and cheddar cheese samples for bacteriological examinations are taken not less than once per month from all manufacturing plants in the Province.

ARTEK AUTOMATIC COLONY COUNTER

Used for counting of Standard Plate Counts and Plate Loop Counts on raw and pasteurized milk samples.

Plate loop bacteria counts are done for each milk producer once per month to insure that bacteriological standard for acceptable milk of "not more than 100,000 per ml" is maintained. It is generally agreed that if milk has been produced and handled properly there should be no difficulty in maintaining a bacteria count of less than 100,000/ml. In fact, over 80% of the producer samples have counts of less than 50,000 (Table 1). Since most of the bacteria present in raw milk produce enzymes capable of producing defects in the pasteurized product their numbers should be low to insure that the final product is of good quality.

TABLE 1

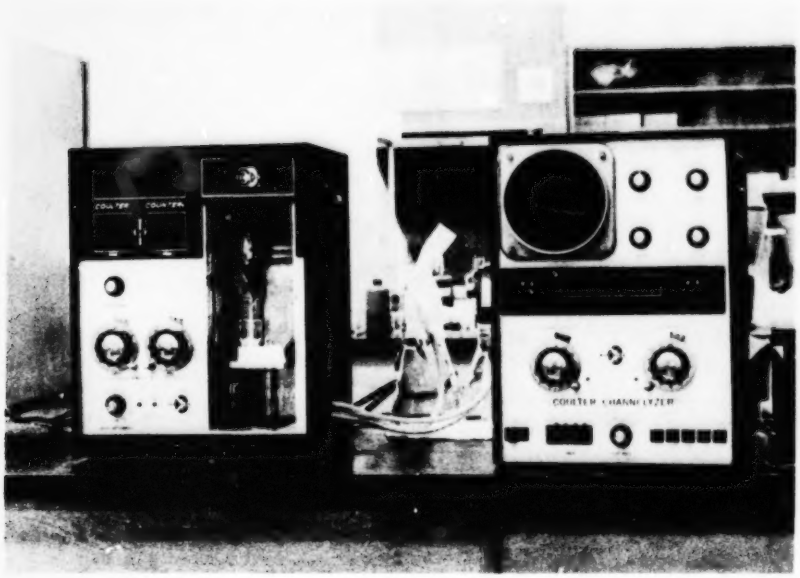
RAW MILK QUALITY - 1981

PLATE LOOP COUNTS

(Counts per ml)

MONTH	PRODUCER SAMPLES	LESS THAN 50,000	PERCENT <50,000	50,000 TO 100,000	PERCENT 50-100,000	MORE THAN 100,000	PERCENT >100,000	TOTAL PLATE LOOP SAMPLES (PRODUCER, TRUCK & SAMPLES)
JANUARY	1320	1070	81.1	217	16.4	33	2.5	1440
FEBRUARY	1350	1064	78.8	196	14.5	34	2.5	1568
MARCH	1358	1103	80.5	227	16.6	28	2.0	1602
APRIL	1295	1073	83.0	180	13.9	42	3.2	1566
MAY	1301	1104	85.0	170	13.1	30	2.3	1569
JUNE	1290	1022	79.2	218	16.9	50	3.9	1564
JULY	1302	1015	78.0	227	17.4	60	4.6	1640
AUGUST	1259	942	74.8	252	20.0	59	4.7	1568
SEPTEMBER	1281	906	70.7	201	15.7	29	2.3	1616
OCTOBER	1287	1162	90.3	99	7.8	26	2.0	1514
NOVEMBER	1270	1073	84.5	162	12.8	35	2.8	1482
DECEMBER	1251	1171	93.6	64	5.1	16	1.2	1502
YEARLY TOTAL	15,564	12,705	81.6%	2213	14.2%	442	2.8 %	18631

SOMATIC CELL COUNTS



COULTER COUNTER AND COULTER CHANNELYZER

The Coulter Counter is used for electronically counting somatic cells in milk.

Coulter Channelyzer is used to determine the range of cell sizes in the milk sample.

Somatic cell counts are done on all milk producer samples once per month. The cell count is reported on a per ml. basis and includes all "body cells" occurring in the milk such as leukocytes and epithelial cells. (Summarized in Table 2). The main causes for elevated cell counts are bacterial infection, mechanical injury from the milking machine, or other "stress" factors and stage of lactation. Associated with elevated cell counts are altered milk composition, flavour defects, decreased milk production, and low yields in cheese production. Producers with consistently high cell counts may be given special attention by the Farm Services Staff in an attempt to find the causes for the high cell count. An important first step is to analyse the milking equipment and methods used. When recommended corrections are made in the herd, an aseptic sample is taken from each quarter of every cow, for analysis on the Coulter Counter and Channelyzer. Selected quarter samples, in addition to examination for cell size distribution, are cultured to determine if there is a bacteriological cause for the elevated count.

TABLE 2

SOMATIC CELL COUNTS - 1981

(Counts per ml)
(m= million)

MONTH	PRODUCERS TESTED	<500,000	%	500 - 1m	%	1m - 1.4m	%	1.5m or>	%
JANUARY	1276	431	34.2	569	45.2	159	12.6	101	8.0
FEBRUARY	1275	363	28.5	601	47.1	194	15.2	117	9.2
MARCH	1276	477	37.4	573	44.9	152	11.9	74	5.8
APRIL	1301	565	43.2	573	44.0	113	8.6	50	3.8
MAY	1304	563	43.2	561	43.0	112	8.6	34	2.6
JUNE	1328	598	45.0	550	41.6	135	10.0	43	3.2
* JULY	1300	605	46.5	535	41.2	119	9.2	41	3.2
* AUGUST	965	478	49.5	393	40.7	72	7.5	22	2.3
* SEPTEMBER	1277	588	46.0	551	43.1	98	7.7	40	3.1
* OCTOBER	1270	738	58.1	412	34.2	97	7.6	23	1.8
* NOVEMBER	1196	737	61.6	376	31.4	58	4.8	25	2.1
* DECEMBER	1266	650	51.3	558	44.0	46	3.6	15	1.6
TOTAL	15,034	6793	45.1 %	6252	41.6 %	1355	9.0 %	585	3.9 %

500,000	6,793	(45.1%)
500,000 to 1m	6,252	(41.6%)
1.0 to 1.4m	1,355	(9.0%)
1.5m or more	585	(3.9%)

897 quarter samples were checked on the Coulter Counter.
313 DMSCC controls were done as a check on Coulter Counter.

* The Fossomatic cell count results are used for samples tested from July to December. The number of shippers over 1 million count dropped as this particular machine tended to give lower readings than the Coulter Counter in this range. Correlation with DMSCC was poor on high count samples.

TABLE 3

MEAN CELL COUNTS ON

HERD BULK MILK - COULTER COUNTER

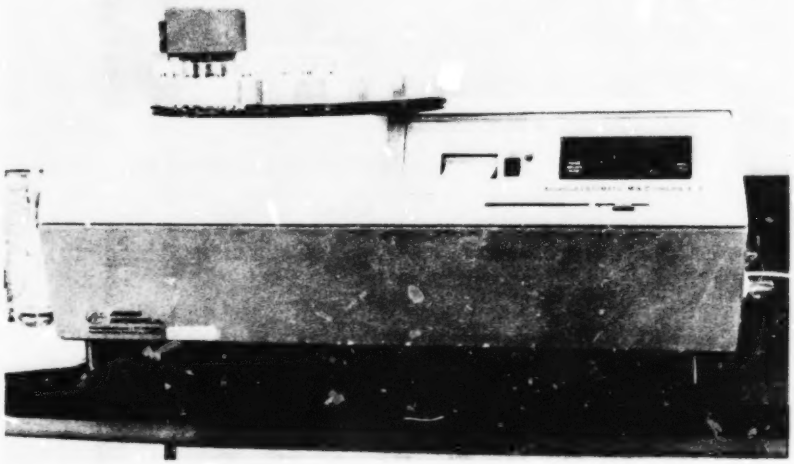
(Counts per ml)

MONTH	1976	1977	1978	1979	1980	1981
JANUARY	785,000	680,000	745,000	684,000	738,000	744,000
FEBRUARY	751,000	774,000	745,000	600,000	720,000	814,000
MARCH	859,000	740,000	758,000	647,000	744,000	696,000
APRIL	760,000	754,000	672,000	622,000	781,000	629,000
MAY	708,000	747,000	705,000	600,000	805,000	612,000
JUNE	746,000	787,000	699,000	660,000	750,000	626,000
JULY	626,000	879,000	769,000	724,000	840,000	622,000
AUGUST	684,000	920,000	765,000	842,000	970,000	561,000
SEPTEMBER	622,000	881,000	684,000	899,000	828,000	571,000
OCTOBER	612,000	815,000	715,000	777,000	757,000	520,000
NOVEMBER	760,000	813,000	751,000	811,000	735,000	510,000
DECEMBER	750,000	789,000	760,000	766,000	718,000	540,000
AVERAGE	722,000	798,000	741,000	748,000	778,000	629,000

ANTIBIOTIC TESTING PROGRAM

In all milk markets the presence of detectable amounts of antibiotics in the milk supply is of concern for two reasons: (1) Presence of antibiotics in milk, particularly penicillin may cause an allergic reaction in persons who are sensitive to it. (2) The presence of small amounts of antibiotics slows or stops the growth of the bacterial culture used in the milk for cultured products and cheese, resulting in loss of production and "dumping" of the milk.

The Dairy Laboratory monitors all shipper samples once per month using Bacillus subtilis disc assay, ½" disc, in addition to checking all tank truck samples. When a shipper sample is found to be "positive" for antibiotics, the producer, farm services inspector and hauler are notified for corrective action. As a result the producer receives a penalty deduction from the Milk Marketing Board. Also, shipments from the producer will not be resumed until a negative test is obtained.



AC11 CRYOSCOPE for detection of added water in milk. Operates automatically including printouts of freezing points.

All milk producer and truck samples are monitored at least once per month. When a reading of $-0.524^{\circ}C$ or higher is obtained on a producer sample it is considered to be adulterated. The Marketing Board is notified and that shipment is paid for at a reduced price.

TABLE 4

ANTIBIOTIC TESTING PROGRAM - 1981

MONTH	PRODUCERS TESTED	TOTAL TESTS DONE	SAMPLES POSITIVE	PRODUCERS POSITIVE	PER CENT OF PRODUCERS IN PENALTY
JANUARY	1,320	1,886	2	2	.15%
FEBRUARY	1,350	1,838	5	5	.37%
MARCH	1,370	2,106	4	4	.29%
APRIL	1,295	2,021	1	1	.08%
MAY	1,301	2,122	2	2	.15%
JUNE	1,290	2,090	1	1	.08%
JULY	1,314	2,432	1	1	.08%
AUGUST	1,259	2,264	2	2	.16%
SEPTEMBER	1,281	2,288	1	1	.07%
OCTOBER	1,287	2,131	4	4	.31%
NOVEMBER	1,258	1,653	2	2	.16%
DECEMBER	1,251	1,962	1	1	.08%
TOTAL	15,576	24,793	26	26	

For the year there were .17% of the milk producers with positive antibiotics.

.10% of all samples tested were positive for antibiotics.

FINISHED PRODUCT TESTING

Bacteriological standards for processed and manufactured dairy products are set out by Regulation. These include Standard Plate Counts and Coliform counts on fluid milk products, Coliform and Staphylococcus counts on cheddar and specialty cheese products. Butter is tested for yeast and mold counts and proteolytic bacteria counts.

The standard for non-cultured fluid milk products is "not more than 10 Coliform bacteria per ml." and "not more than 20,000 Standard Plate Count per ml. The standard for cultured products is "not more than 10 Coliforms per ml." Products exceeding the standards are retested and if found to exceed the standard, the product is subject to recall from the market.

Testing for various bacteria in pasteurized dairy products is done to determine potential sanitary problems at the dairy plant. High bacteria counts in the packaged product is largely due to post pasteurization contamination. In addition, all pasteurized dairy products are tested for adequate pasteurization by the use of the phosphatase test. Products which have not been heated to pasteurization temperature for sufficient time, or have been contaminated with small amounts of raw milk, will fail the test. If a product gives a positive test it is subject to immediate recall from the market.

The Standard Plate Count and Coliform count are used as a measure on pasteurized fluid products of the sanitary handling of the milk at the dairy plant. The types of bacteria found in pasteurized milk are predominately spoilage organisms and usually cause flavor defects. Usually associated with low bacteria count in the pasteurized milk is a longer storage life for the product and improved flavor and quality for the consumer.

TABLE 5

FINISHED PRODUCT QUALITY - 1981

PRODUCT	COLIFORM COUNTS NUMBER OF TESTS	>10/ml	%>10/ml	STANDARD PLATE COUNT NUMBER OF TESTS	>20,000/ml	%>20,000/ml
Homo	885	8	.90%	882	13	1.5%
Low Fat Homo	677	8	1.2%	677	5	.7%
Cereal Cream	652	7	1.1%	645	3	.5%
Whipping Cream	414	0	0	441	9	2.0%
Chocolate Drink	305	12	3.9%	320	8	2.5%
Skim Milk	478	6	1.3%	476	5	1.1%
Ice Cream	297	26	8.7%	290	12	4.1%
Ice Cream Mix	249	10	4.0%	248	6	2.4%
Cottage Cheese	206	17	8.3%			
Buttermilk	164	9	5.5%			
Salad Cream	169	8	4.7%			
TOTAL	4543	111	2.4%	3979	61	1.5%

KEEPING QUALITY TESTS

This program was continued in 1982 with 193 Homogenized Milk and 239 low fat 2% samples tested.

Many flavor defects in pasteurized products are due to bacterial growth during storage. Routine bacteria counts are done on freshly pasteurized product picked up at the Dairy Plant and are very low (less than 300 per ml), however the maximum standard is 20,000/ml. These same samples, when held for 5 days @ 7°C and then tested, may still have a low count or may have increased to 250,000 per ml or more. The bacteria count after storage is from bacteria which can grow at low temperatures and is indicative of the degree of contamination of the pasteurized product by psychrotrophic bacteria. If a processing plant produces low counts after storage (5 days @ 7°C), shelf life and flavor quality is likely to be improved. The basis of the test is to detect potential spoilage bacteria which will shorten the shelf life of the pasteurized product. Note Table 6, less than 0.5% of all fresh samples tested were over 20,000 standard plate counts while 20.6% of samples tested after storage for 5 days at 7°C had counts of over 250,000 per ml.

CRYOSCOPE ON PASTEURIZED PRODUCTS

Under the Dairy Act, milk is considered adulterated if by test it is determined that there is "added water" in the product. The degree of adulteration is determined by measuring the freezing point of the milk, similar to the test used on raw milk. A freezing point of -0.524° or higher is considered to be adulterated and such products are subject to recall. Pasteurized products regularly tested are Homogenized milk, Low Fat Homo, and Skim Milk.

TABLE 6

KEEPING QUALITY TESTS 1981

(5 days @ 7°C then SPC)

PRODUCT	TOTAL	50,000/ml	51-100,000/ml	101-250,000/ml	250,000/ml
Homo	193	140 (72.5%)	5 (3.1%)	7 (3.6%)	41 (21.2%)
Low Fat Homo 2%	239	182 (76.1%)	2 (.8%)	7 (2.9%)	48 (20.0%)

Initial tests on all samples were less than 20,000, except for 1 Homo sample and 1-2% sample.

PHOSPHATASE TESTING

Products Tested: Homo, 2%, Skim, Cereal Cream, Whipping Cream, Ice Cream Mix, and Cottage Cheese.

Total number of tests: 3,584

100% negative for phosphatase.

The phosphatase test is used to determine if a product has been properly pasteurized or if the pasteurized product has been recontaminated with raw product. The test measures residual phenol in the sample. Raw milk gives a high phenol reading while a pasteurized sample will give values of less than 2 ug of phenol per 0.5 ml of fluid dairy product; or for cheese, a reading of less than 2 ug of phenol per 0.25 gm. Results showing more than 2 ug are reported as positive phosphatase.

TABLE 7

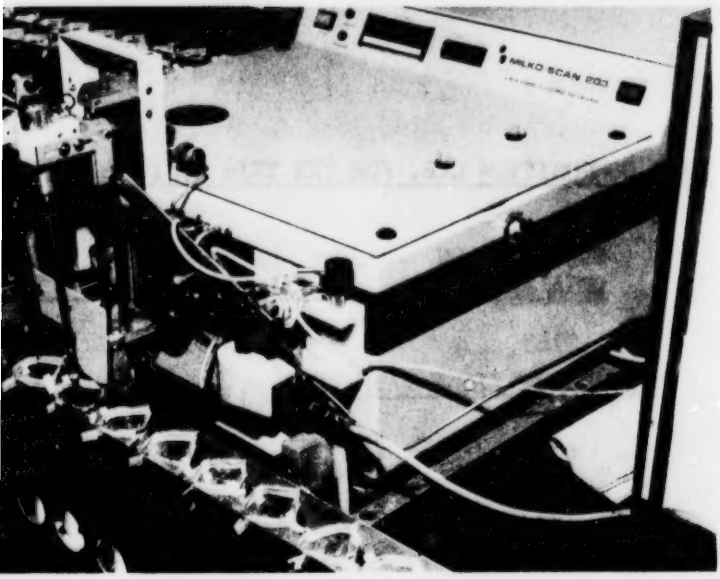
GRYOSCOPE - RAW MILK - 1981

MONTH	PRODUCER SAMPLES	-0.524° OR HIGHER	PERCENT	NORMAL	PERCENT	TRUCK SAMPLES	-0.524° OR HIGHER	PERCENT	TOTAL CRYOSCOPES
JAN.	1,426	8	.6	1,418	99.4	120	0	0	1,546
FEB.	1,334	8	.61	1,326	99.4	123	0	0	1,457
MAR.	1,406	6	.45	1,400	99.5	116	0	0	1,522
APR.	1,357	8	.62	1,349	99.4	135	0	0	1,492
MAY	1,311	7	.54	1,303	99.4	125	0	0	1,436
JUNE	729	2	.15	727	99.7	127	0	0	856
JULY	224	3	.23	221	99.7	143	0	0	367
AUG.	106	1	.08	105	99.0	144	0	0	250
SEPT.	404	3	.23	401	99.2	114	0	0	518
OCT.	1239	4	.31	1235	99.4	120	0	0	1359
NOV.	1413	5	.39	1406	99.6	110	0	0	1523
DEC.	1251	4	.32	1247	99.7	113	0	0	1364
TOTAL	16,272	59	0.48%	12,141	99.5%	1,490	0	0	13,690

TABLE 8

CRYOSCOPE - PASTEURIZED MILK - 1981

MONTH	TOTAL	FREEZING POINT -0.524° or HIGHER	PER CENT -0.524° OR HIGHER
JANUARY	161	2	1.4
FEBRUARY	147	4	2.7
MARCH	181	6	3.3
APRIL	156	5	3.2
MAY	156	3	1.9
JUNE	116	4	3.4
JULY	178	3	1.7
AUGUST	175	1	.6
SEPTEMBER	132	0	0
OCTOBER	183	0	0
NOVEMBER	120	4	3.3
DECEMBER	88	1	1.1
TOTAL	1,793	33	AVERAGE 1.8%

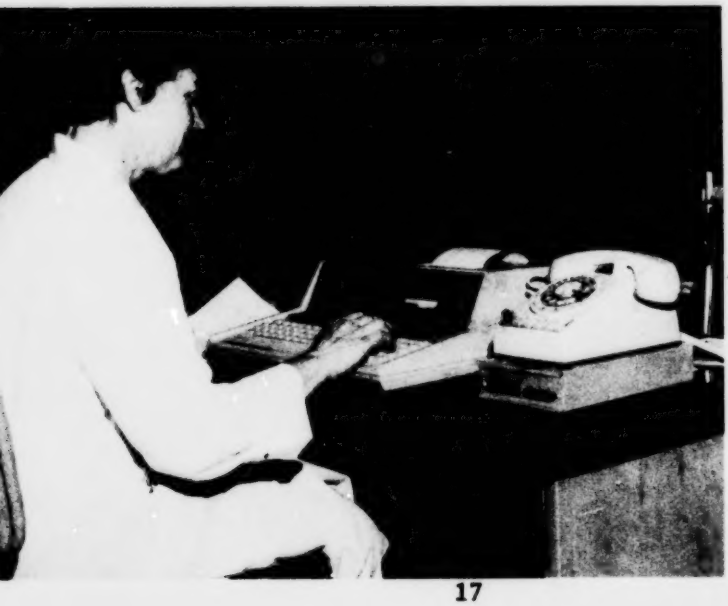


MILKO SCAN 203

Tests for fat, protein and lactose by infrared. This equipment can test up to 220 samples per hour.

Butterfat, protein and lactose is determined on raw milk samples for e Dairy Herd Improvement Association, Owner Sampler programs and the nitoba Milk Producers' Marketing Board. The Manitoba Milk Producers' rketing Board use the butterfat tests as a basis of payment with protein l lactose results being stored for future use. Table 11 gives a summary the average monthly fat tests for 1980 and 1981. The average protein sts are included for the same period. Table 12 gives average lactose nparisons for 1980 and 1981.

Butterfat testing of pasteurized dairy products is done to determine if ch product meets the legal standard for butterfat. The minimum butterfat ntent for each product is stated on the container. Dairy products are subject recall by the dairy plant if three consecutive tests are outside the acceptable limit.



Hewlett Packard 85 Controller

TABLE 9

TESTS PERFORMED IN MILK COMPOSITION LAB. FOR THE YEAR 1981

MONTH	BUTTERFAT ON PRODUCER SAMPLES	BUTTERFAT ON DHIA AND O/S	TOTAL PROTEINS & LACTOSE
JANUARY	5394	7143	12,537
FEBRUARY	5476	8054	13,530
MARCH	6116	9796	15,912
APRIL	4612	9865	14,477
MAY	5297	9671	14,968
JUNE	4965	9974	14,939
JULY	5529	9720	15,249
AUGUST	6047	8990	15,037
SEPTEMBER	5064	11190	16,254
OCTOBER	5663	11363	17,026
NOVEMBER	5711	11302	17,013
DECEMBER	4976	9771	14,747
TOTAL	64850	116839	181,689

In addition to the regular compositional tests on Producer & DHIA Samples there were samples tested for quality control, laboratory and inter-laboratory comparisons, and quality standards. The number of such tests for the year was 1,851.

January	147	August	238
February	91	September	165
March	200	October	138
April	149	November	150
May	134	December	230
June	104	TOTAL	1851
July	238		

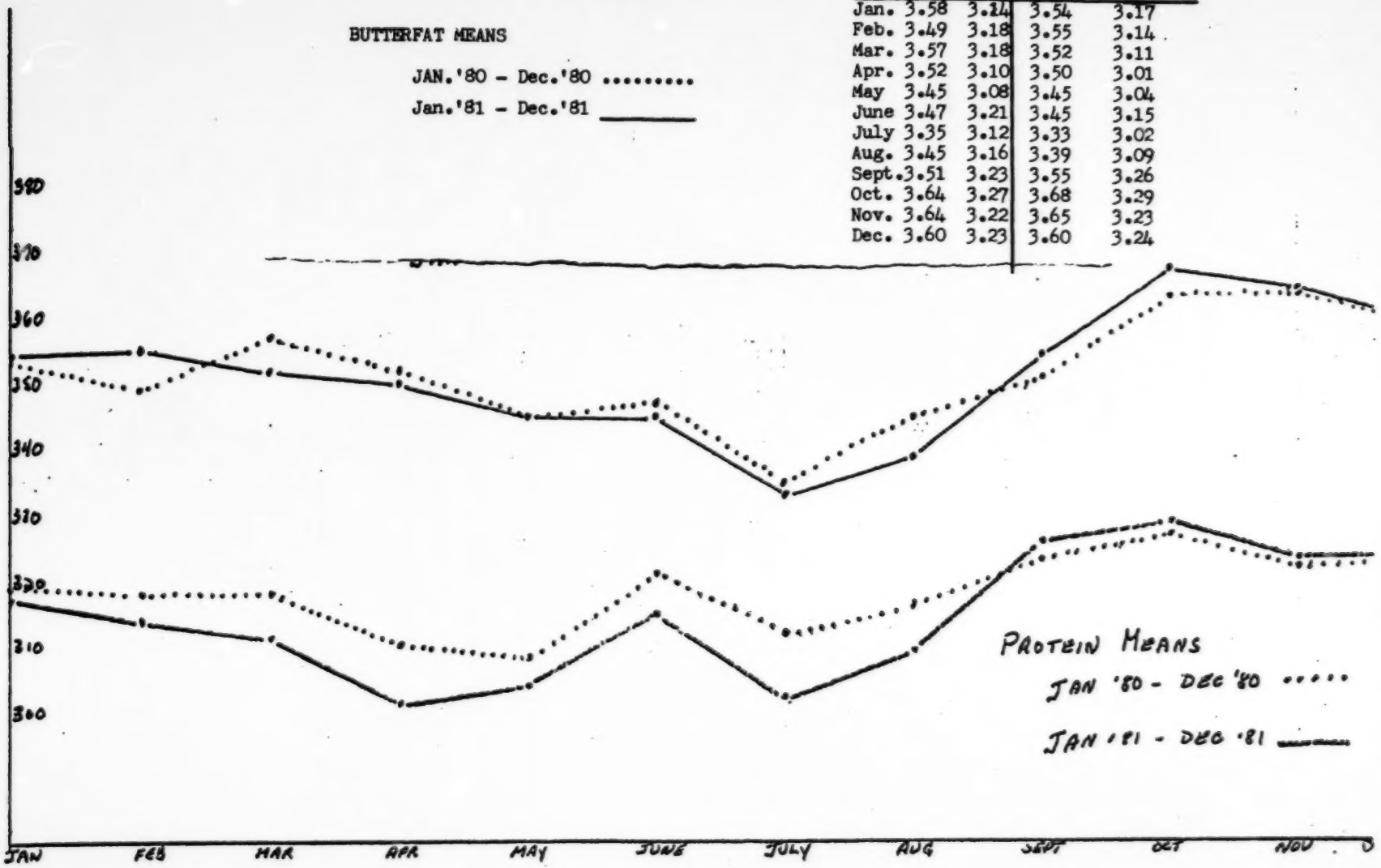
TABLE 10

BUTTERFAT TESTS ON FINISHED PRODUCTS

MONTH	TOTAL TESTS	OUTSIDE STANDARD	PER CENT OUTSIDE STANDARD
JANUARY	300	48	16.0
FEBRUARY	299	23	7.7
MARCH	343	15	4.4
APRIL	323	19	5.9
MAY	343	29	8.5
JUNE	277	34	12.3
JULY	385	43	11.2
AUGUST	362	38	10.5
SEPTEMBER	311	33	10.6
OCTOBER	336	33	9.8
NOVEMBER	275	13	4.7
DECEMBER	279	19	6.8
TOTAL	3833	347	AVERAGE 9.1%

BUTTERFAT AND PROTEIN MEANS

	1980 BF.	1980 Protein	1981 B.F.	1981 Protein
Jan.	3.58	3.14	3.54	3.17
Feb.	3.49	3.18	3.55	3.14
Mar.	3.57	3.18	3.52	3.11
Apr.	3.52	3.10	3.50	3.01
May	3.45	3.08	3.45	3.04
June	3.47	3.21	3.45	3.15
July	3.35	3.12	3.33	3.02
Aug.	3.45	3.16	3.39	3.09
Sept.	3.51	3.23	3.55	3.26
Oct.	3.64	3.27	3.68	3.29
Nov.	3.64	3.22	3.65	3.23
Dec.	3.60	3.23	3.60	3.24



LACTOSE MEANS
DECEMBER, 1981

	1980	1981
Jan.	4.75	4.74
Feb.	4.75	4.73
Mar.	4.74	4.74
Apr.	4.83	4.72
May	4.76	4.75
June	4.85	4.76
July	4.74	4.68
Aug.	4.70	4.70
Sept.	4.71	4.68
Oct.	4.65	4.68
Nov.	4.60	4.71
Dec.	4.69	4.66